



April 11, 2002

TO:

M Russell/R. Blair

Northwest Region, NB82-55

FROM:

len/W.S. Hegge

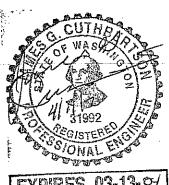
Geotechnical Branch, 47365

SUBJECT:

SR 543, OL-3500

SR 5 to International Boundary Modifications

Geotechnical Memorandum



This memorandum represents geotechnical recommendations for the design and construction of signal pole foundations for the SR 543, SR 5 to International Boundary Modifications project. The signal poles will be located at the four corners of the intersections of SR 543 and Boblett Street at approximate Station 0+870 and H Street at approximate Station 1+250. Figures 1A and 1B show these two intersections. At this time, the signal pole locations have not been finalized.

The analyses, conclusions, and recommendations presented in this memorandum are based on the project description and site conditions that existed at the time of the field exploration. If different subsurface conditions are encountered or appear to be present, we should be contacted so that we can reevaluate our recommendations and assist you.

## FIELD EXPLORATIONS

Four test borings were conducted to evaluate subsurface conditions at the location of the two intersections. TH-1-01 and TH-2-01 were drilled in the vicinity of the intersection of SR 543 and Boblett Street. TH-3-01 and TH-4-01 were drilled in the vicinity of the intersection of SR 543 and H Street. The locations of these borings are shown on the site plans, Figures 1A and 1B in Appendix A. Standard penetrometer tests and soil samples were generally taken at variable intervals in each hole. The Unified Soil Classification System was used to classify the selected samples. Visual classification included consistency, color, water content, and major soil type. The edited boring logs are shown in Appendix B.

#### PROJECT SOIL CONDITIONS

Based on our test borings, the area of the proposed signal pole foundations appears to be underlain by Bellingham Glaciomarine Drift (GMD), consistent with the geologic mapping for this area. The sediment that forms the GMD was derived from the melting of floating glacial ice and was subsequently deposited on the sea floor. Glaciomarine drift was deposited during the Everson Interstade approximately 11,000 to 12,000 years ago. The relative sea level was as high as Elevation 600 feet MSL. The thickness is indicated as a maximum of 70 feet, although greater thicknesses of this unit have been observed in Whatcom County. This soil unit typically consists of unsorted, unstratified silt and clay with varying amounts of sand, gravel, cobbles and occasional boulders. Localized sand stringers or "pods" can be encountered with the GMD deposit and are generally wet. The upper portion of this unit, sometimes to about 15 feet of depth, can be stiff as a result of desiccation or partial ice contact in upland areas and it typically grades to medium stiff/soft at depth. The material encountered in the borings falls into two broad categories, the stiff crust and the underlying soft GMD.

Groundwater was encountered at the following depths in the borings:

Depth to Ground Water **Ground Elevation (ft) Boring Number** (ft) 2.5 69.7 TH-1-01 71.0 2.6 TH-2-01 8.0 73.8 TH-3-01 1.0 75.6 TH-4-01

Table 1 - Ground Water Depths

The depth of 8 feet to ground water that was recorded in TH-3-01 was recorded during drilling and probably represents a transient condition. Based on the ground water data observed in the borings, the signal pole foundations should be designed for ground water at the ground surface.

#### GEOTECHNICAL RECOMMENDATIONS

Due to the loose/soft nature of the soils, a special foundation design is required. We recommend that the signal pole foundations be supported on shafts. The shaft's lateral capacity should be computed using the P-Y iterative method. At the present time, we do not know the final configuration of the signal pole foundations. This, combined with the fact that only two of the four corners of each intersection were drilled, makes it difficult to provide specific recommendations for each signal pole location. Therefore we have provided a single recommendation for each intersection based upon the poorest geotechnical conditions observed

M Russell/R. Blair April 11, 2002 Page 3

at that intersection. We anticipate that some strain softening will occur during cyclic loading and therefore we have provided separate static and cyclic soil stiffness parameters. Cyclic loads are those imposed by repeated forces such as wind. We do not anticipate any significant amount of liquefaction within the site soils during a seismic event. Consequently, no reduced P-Y parameters are provided for a design earthquake event. P-Y curve input parameters to be used for the drilled shafts are presented in Appendix C.

#### CONSTRUCTION CONSIDERATIONS

Shafts should be constructed in general accordance with WSDOT's drilled shaft GSP without the requirement for Crosshole Sonic Logging (CSL) testing. Due to the shallow level of the groundwater and to the very soft/loose nature of the soils at the proposed pole locations, wet shaft construction should be expected. As a result we recommend full depth temporary casing. The Bridge and Structures design office will need to add the drilled shaft GSP to the contract documents and determine the required temporary casing tip elevation once structural design is completed.

If you have questions or require further information, please contact William Hegge at (360) 709-5415.

TA:JC:ds/wh

Attachments: Appendix A - Figures

Appendix B - Field Investigation Appendix C - P-Y Input Parameters

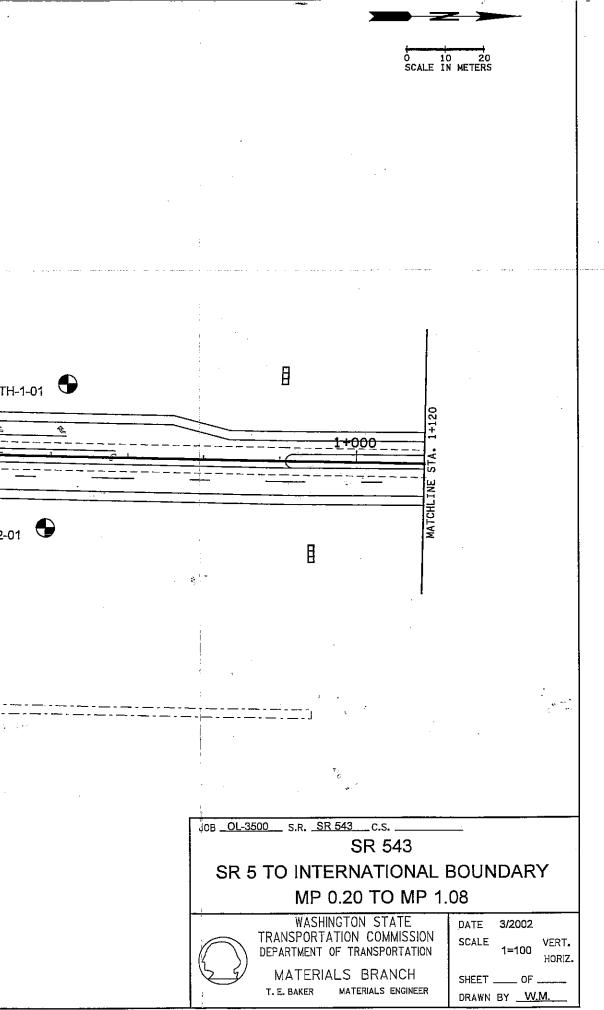
cc: Ahmad Schafi, Northwest Region NB82-120

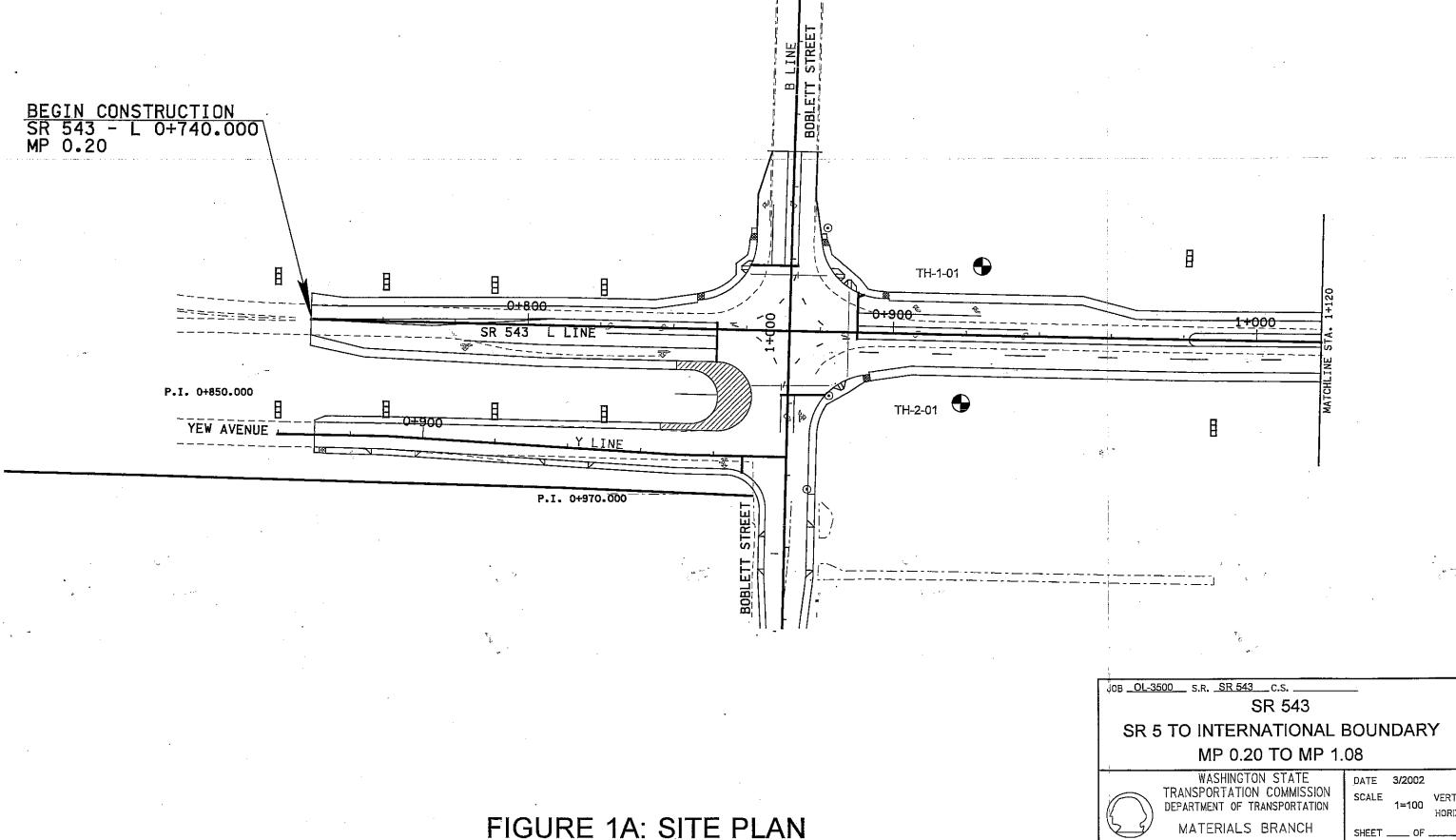
C. Johnson/H. Clayton, Northwest Region NB82-29

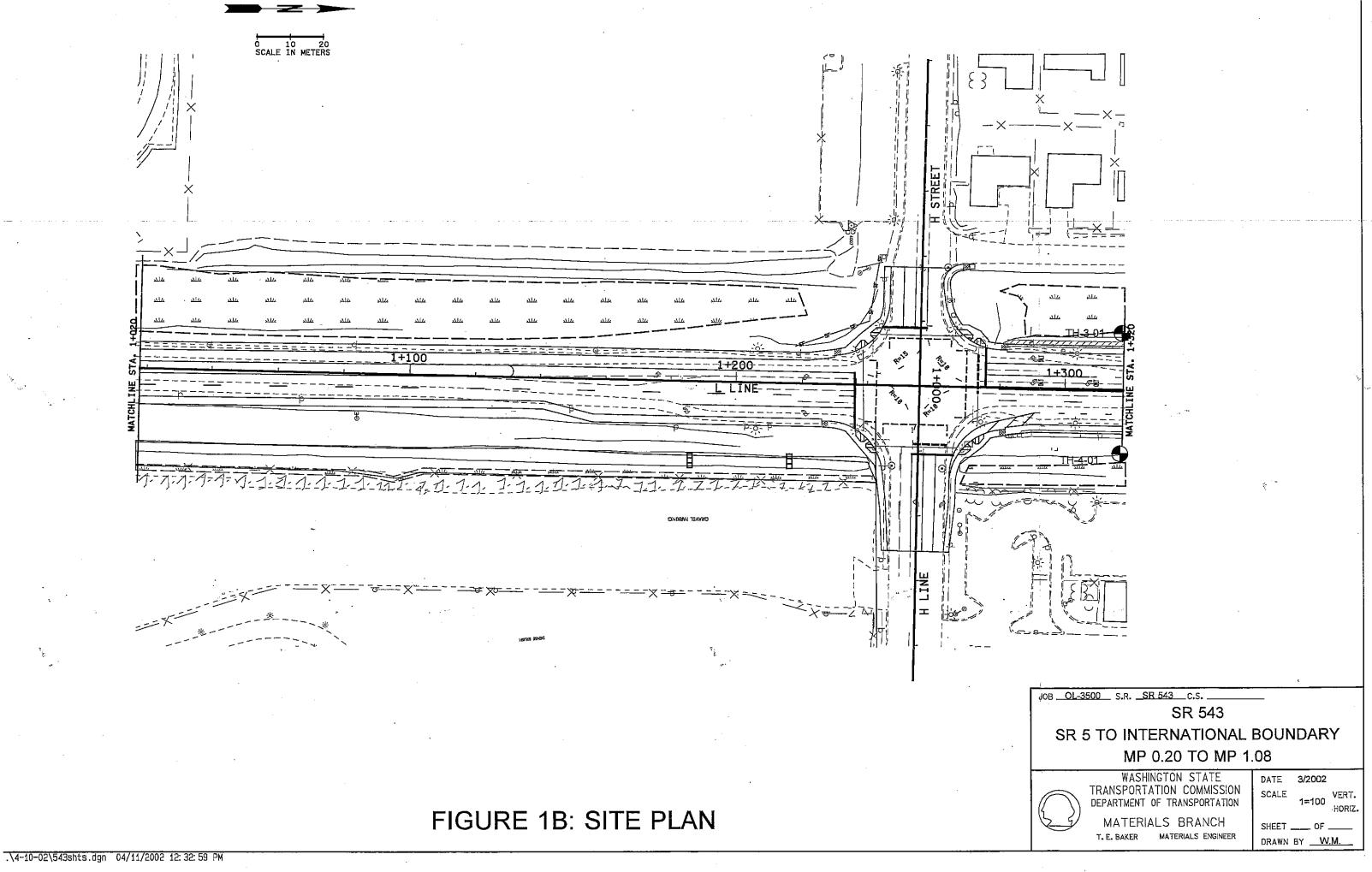
T. Harrison, Northwest Region NB82-54

Asad Bushnaq, Bridge and Structures 47340

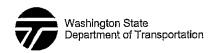
**APPENDIX A - FIGURES** 







APPENDIX B - FIELD EXPLORATIONS



# **Test Boring Legend**

	Sampler Symbols
	Standard Penetration Test
	Oversized Penetration Test (Dames & Moore, California)
	Shelby Tube
P	Piston Sample
	Washington Undisturbed
	Vane Shear Test
	Core
0.00	Becker Hammer
B	Bag Sample

	Well Symbols
	Cement Surface Seal
	Piezometer Pipe in Granular Bentonite Seal
D A A	Piezometer Pipe in Sand
	Well Screen in Sand
	Granular Bentonite Bottom Seal
	Inclinometer Casing in Concrete Bentonite Grout

		aboratory Testing Codes
	UU	Unconsolidated Undrained Triaxial
l	CU	Consolidated Undrained Triaxial
	CD	Consolidated Drained Triaxial
	UC	Unconfined Compression Test
	DS	Direct Shear Test
	CN	Consolidation Test
	GS	Grain Size Distribution
	МС	Moisture Content
	SG	Specific Gravity
	OR	Organic Content
	DN	Density
	AL	Atterberg Limits
	PT	Point Load Compressive Test
	SL	Slake Test
	DG	Degradation
	LA	LA Abrasion
	Į.	

	Soil Density	y Modifie	ers
Gravel,	Sand & Non-plastic Silt	Elasti	c Silts and Clay
SPT Blows/ft	Density	SPT Blows/ft	Consistency
0-4	Very Loose	0-1	Very Soft
5-10	Loose	2-4	Soft
11-24	Medium Dense	5-8	Medium Stiff
25-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very Stiff
		31-60	Hard
		>60	Very Hard

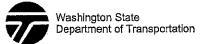
Á	ngularity of Gravel & Cobbles
Angular	Coarse particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Coarse grained particles are similar to angular but have rounded edges.
Subrounded	Coarse grained particles have nearly plane sides but have well rounded corners and edges.
Rounded	Coarse grained particles have smoothly curved sides and no edges.

Sc.	oil Moisture Modifiers	
Dry	Absence of moisture; dusty, dry to touch	1
Moist	Damp but no visible water	
Wet	Visible free water	

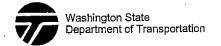
ing a state of the	Soil Structure
Stratified	Alternating layers of varying material or color at least 6mm thick; note thickness and inclination.
Laminated	Alternating layers of varying material or color less than 6mm thick; note thickness and inclination.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensided	Fracture planes appear polished or glossy, somtimes striated.
Blocky	Cohesive soil that can be broken down into smaller angular lumps which resist further breakdown.
Disrupted	Soil structure is broken and mixed. Infers that material has moved substantially - landslide debris.
Homogeneous	Same color and appearance throughout.

	HCL Reaction
No HCL Reaction	No visible reaction.
. Weak HCL Reaction	Some reaction with bubbles forming slowly.
Strong HCL Reaction	Violent reaction with bubbles forming imediately.

Degree of	Vesicularity of Pyroclastic Rocks
Slightly Vesicular	5 to 10 percent of total
. Moderately Vesicular	10 to 25 percent of total
Highly Vesicular	25 to 50 percent of total
Scoriaceous	Greater than 50 percent of total



	Job I	No.	0L-3500		SR		543		HOLE No. TH-1-01			
				national Boundar					Sheet <u>1</u> of <b>2</b>			
	PRO	JECT	1-5 to litter		·				Increator Prion Hilto		٠	
		į										•
	Stati	on _				0	ffset _		Equipment CME 55 w/ autoh	<u>amm</u>	<u>ier</u>	
	Latit	ude				Lo	ongitudi	e	Method Wet Rotary			
	Nort	hing	323096.5		· .	E	asting _	4607	97.6 Casing HQx32			
	Grou	ınd Elev	vation <u>69.8 (</u>	21.3 m)	<del></del>	S	tart Dat	e <u>Nov</u>	vember 6, 2001 Completion Date November 6	2001	1	
	Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft 20 30 40	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument	וופוומוופוור
	5	- -1 - -2			1 3 7 (10) 8 9 12 (21) 3 4 6 (10) 5 4 5 (9) 5 6 4 (10)		D-1 D-2 D-3 D-4	GS MPI SSC PI SSC PI SSC PI	Fat CLAY, stiff, dark grayish brown, moist, Homogeneous, no HCl reaction, With hair roots and FeO stains.  Length Recovered 1.5 ft, Length Retained 1.5 ft  1/11/02 11/20/01  CH, MC=28%, PI=25 Fat CLAY, very stiff, dark grayish brown, moist, Homogeneous, no HCl reaction, with FeO stains throughout.  Length Recovered 1.5 ft, Length Retained 1.5 ft Fat CLAY, stiff, dark grayish brown, moist, Homogeneous, no HCl reaction, with FeO stains and a trace of hair roots.  Length Recovered 1.2 ft, Length Retained 1.2 ft CH, MC=47%, PI=26 Fat CLAY, stiff, dark grayish brown, moist, Homogeneous, no HCl reaction  Length Recovered 1.5 ft, Length Retained 1.5 ft CH, MC=44%, PI=37 Fat CLAY, stiff, grayish brown, moist, no HCl reaction,		XXXXXXXXXXX	KKKKKKKKKKKKKK
OLSS00 I-5 TO INTERNATIONAL BOUNDARY GPJ SOIL, GDT 4/11/02/012:35:42 P4	10	3			0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		D-6 D-7 D-8 D-9	GS MC PI GS MC	laminated with sand lenses. Length Recovered 1.5 ft, Length Retained 1.5 ft CH, MC=49%, PI=39 Fat CLAY, very soft, gray, moist, Homogeneous, no HCI reaction Length Recovered 1.5 ft, Length Retained 1.5 ft Fat CLAY, very soft, gray, moist, Homogeneous, no HCI reaction, moist to wet Length Recovered 1.5 ft, Length Retained 1.5 ft CH, MC=75%, PI=57 Fat CLAY, very soft, gray, moist, Homogeneous, no HCI reaction, moist to wet Length Recovered 1.5 ft, Length Retained 1.5 ft  Fat CLAY, very soft, gray, moist, Homogeneous, no HCI reaction, moist to wet Length Recovered 1.5 ft, Length Retained 1.5 ft  CH, MC=78%, PI=50		**************************************	KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK
SOIL OL	20-	<b>-</b> 6			0			MC Pl	Fat CLAY, very soft, gray, moist, Homogeneous, no HCl reaction, moist to wet			Ž



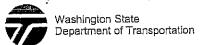
Joh No

0L-3500 \_\_\_\_\_

SR \_\_\_\_\_543

HOLE No. TH-1-01

Sheet \_\_2 of \_2 I-5 to International Boundary **PROJECT** Groundwater Sample Type Sample No. Standard (Tube No.) Meters (m) SPT Depth (ff) Tests Profile Penetration Lab Description of Material Blows/6' Blows/ft (N) 30 Length Recovered 1.5 ft, Length Retained 1.5 ft (0) CH, MC=72%, PI=59 Fat CLAY, very soft, gray, moist, Homogeneous, no HCl 0 D-11 GS MC 0 ы reaction, possibly lean clay 0 Length Recovered 1.5 ft, Length Retained 1.5 ft (0)25 Fat CLAY, very soft, gray , moist, Homogeneous, no HCl reaction, moist to wet 0 D-12 0 Length Recovered 1.5 ft, Length Retained 1.5 ft 0 30 End of test hole boring at 30 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications 10 and laboratory test data. SOIL OL3500 L5 TO INTERNATIONAL BOUNDARY GPJ SOIL GDT 4/11/02D12:35:43 P4 35 12 40 13



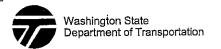
Job	No.	0L-3	500			<del></del>	SR		543		HOLE NoTH-2-01	
PR(	OJECT	1-5 to	Inter	natio	nal Bo	oundai	ry				Sheet <u>1</u> of <u>2</u>	
											Inspector Mike Mulhern	
Sta	tion							0	ffset .		Equipment BK-81 w/ autohammer	
Lati	tude –							Lo	ongitud	e	Method Wet Rotary	
	thing	323	103.4					E	asting	4608	35.8 Casing HQ	
	<del>-</del>				m) .					te No	vember 6, 2001 Completion Date November 6, 2001	
	T	Zauoi,						1				
Depth (ft)	Meters (m)	Profile		Pe B	landard netration liows/ft		SPT Blows/6 (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Groundwater Instrument	
10	-2 -34	× × × × × × × × × × × × × × × × × × ×	11	0 20 T T T T T T T T T T T T T T T T T T	30	40	1 2 2 (4) 2 3 5 (8) 2 2 5 (7) 1 1 1 (2) 0 0 1 (1) 0		D-1 D-2 D-3 D-4 D-5 D-5	MC PI GS	Elastic SiLT, loose, olive brown, moist, Homogeneous, no HCI reaction, organics throughout Length Recovered 0.5 ft, Length Retained 0.5 ft  MH, MC=37%, PI=24 Elastic SiLT, loose, olive brown, moist, Homogeneous, no HCI reaction, very moist Length Recovered 1.5 ft, Length Retained 1.0 ft  CL, MC=47%, PI=25 Lean CLAY, medium stiff, olive brown, moist, Homogeneous, no HCI reaction, some organics, trace sand Length Recovered 1.5 ft, Length Retained 1.0 ft  CH, MC=61%, PI=50 Fat CLAY, soft, grayish brown, wet, Homogeneous, no HCI reaction Length Recovered 1.5 ft, Length Retained 1.0 ft  CH, MC=74%, PI=44 Fat CLAY, very soft, gray, wet, Homogeneous, no HCI reaction Length Recovered 1.5 ft, Length Retained 2.0 ft  CH, MC=74%, PI=44 Fat CLAY, very soft, gray, wet, Homogeneous, no HCI reaction Length Recovered 1.5 ft, Length Retained 1.0 ft	
15 15	;- <del> </del>			<u> </u>	 		0 -1-(1)			MC P!	Fat CLAY, very soft, gray, wet, Homogeneous, no HCI  -reaction—  Length Recovered 1.5 ft, Length Retained 1.0 ft	X
SOIL 013500 1-5 TO INTERNATIONAL BUNNATURE SCIENCE COLLEGE COL	5											XXXXX
SOIL OL35	6			!   	! ! !		0		D-7	7	Lean CLAY, very soft, gray, wet, Homogeneous, no HCI reaction	X X

Job No. <u>0L-3500</u>

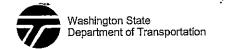
SR <u>543</u>

HOLE No. TH-2-01

PRO	DJECT	1-5 t	o inte	rnatio	onal E	Bound	dary						Sheet 2 of 2	
Depth (ft)	Meters (m)	Profile	1	. Pe	Standard enetration Blows/fl	on t	<b>o</b>	SPT Blows/6" (N)	Sample Type	Sample No.	de I	Tests	Groundwater Groundwater	
-								1 (1)	X				Length Recovered 1.5 ft, Length Retained 1.0 ft	TXX
25—	—7 - —8							0 0 1 (1)	X	D-8			Lean CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.0 ft	
30	-9		•				*	0 0 1 (1)	X	D-9		GS MC PI	CL, MC=73%, PI=15 Lean CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.0 ft	
-	10	,		]               				T. T				ŧ	End of test hole boring at 30.5 ft below ground elevation.  This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.	
35—	11				 		  -  -  -  -							
40-	—12 ——12				 	1								
40-	-13				 	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	             							
45-	<u> </u>			     	       	     	! ! ! !							



Job No.	<u>0L-3500</u>		SR		<u>543</u>		HOLE No		
PROJECT	I-5 to Intern	ational Boundary					Sheet1_ of6_		
							Inspector Hanning		
Station					fset		Equipment CME 850 w/ autoha	ımm	er
Latitude				Lc	ngitud	e	Method Wet Rotary		
Northing	323480.8			E	asting	4608	<b>08.1</b> Casing <b>HQ</b>		
Ground E	ievation 73.8 (2	22.5 m)			art Dat	e Dec	cember 11, 2001 Completion Date December 12,	2001	<del></del>
	levation						and the second s	<u>5</u>	
Depth (ft)	Profile	Standerd Penetration Blows/ft	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	10	20 30 40	1 1	V	D-1	GS MC	CH, MC=48%, PI=36 Fat CLAY, soft, gray brown, moist, Homogeneous, no		
			1 2	X		PI	HCl reaction Length Recovered 1,2 ft, Length Retained 1.2 ft	-	
-	<b>□</b>		(2)		D-2		Fat CLAY, medium stiff, gray brown, moist,	-	
			3 2 3	I			Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
			(5)		U-3		Fat CLAY, gray brown, moist, Homogeneous, no HCI	_	ļ
5			1		A B C		reaction Length Recovered 1.0 ft, Length Retained 1.0 ft	_ {	
			0		D-4	GS	CH, MC=62%, PI=39	-	
-2			0	Y		MC Pl	Fat CLAY, very soft, dark gray, moist, Homogeneous, no HCl reaction		
			(0)				Length Recovered 1.5 ft, Length Retained 1.5 ft  12/12/01	모	
								  -  -	ļ
Z 3			0 0		D-5		Fat CLAY, very soft, dark gray, moist, Homogeneous, no HCI reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
10 0			0 (0)				Longar Robotolog 1.5 II, Longar Robinson 115 II		
11/02011					U-6 A		Fat CLAY, dark gray, moist, Homogeneous, no HCl réaction		
GDT 4/					B C D		Length Recovered 2.0 ft, Length Retained 2.0 ft		ı
108 7			0	A	DF)	GS MC	CH, MC=62%, PI=40 Fat CLAY, very soft, dark gray, moist, Homogeneous, no	-	I
JARY.GF			0 0	A		PI	HCI reaction Length Recovered 1.5 ft, Length Retained 1.5 ft	-	
15— 15—			(0)						
TIONAL									
SOIL OL3500 L5 TO INTERNATIONAL BOUNDARY.GPJ SOIL.GDT 4/1/02/012:35:45 P4								-	
15 10 11									
013500			0	_	) ) ) D-8	GS	ML, MC=32%, PI=22	+	
1000 -6		<u> </u>	ō			МС	SILT with sand, very loose, dark gray, moist,	<u> </u>	ļ 



Job No.

0L-3500

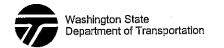
SR \_\_\_\_\_**543** 

HOLE No. TH-3-01

PROJECT \_\_I-5 to International Boundary

Sheet 2 of 6

PF	ROJECT	!-5 to lr	nternation	al Bound	lary					Sheet <u>2</u> of <u>6</u>		
Depth (ft)	Meters (m)	Profile	Pene	ndard tration ws/ft 30 40		SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab	Description of Material	Groundwater	Instrument
-	-					0 0 (0)	X		PI	Homogeneous, no HGI reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	-7					0		D-9		SILT with sand, very loose, dark gray, moist,	-	
25	8					0 0 0 (0)	X			Homogeneous, no HCI reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
30	9					0 0 0 (0)	X	D-10		SILT with sand, very loose, dark gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	10							S-11		SILT with sand, very loose, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 2.0 ft, Length Retained 2.0 ft		₹ <sup>11</sup>
35:45 P4	; <u> </u>						7	S-12		No Recovery	-	1-18- 1.
L.GDT 4/11/02[012:	<del>-</del> -11				   			S-13		SILT with sand, very loose, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 0.7 ft, Length Retained 0.7 ft		
JUNDARY.GPJ SOI	-12				           	0 0 0 0 (0)		D-14	GS MC PI	CH, MC=35%, PI=38 Fat CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft	-	
NTERNATIONAL BC	-				 	,					-	-
SOIL 0L3500 L5 TO INTERNATIONAL BOUNDARY.GPJ SOIL.GDT 4/11/02[1]2:3	-13 -			1	       	0 0	X	D-15		Fat CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction	-	



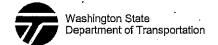
Joh No

0L-3500

SR \_\_\_\_\_\_543\_\_\_

HOLE No. TH-3-01

Sheet 3 of 6 I-5 to International Boundary PROJECT Groundwater Sample Type Sample No. (Tube No.) Instrument Standard Meters (m) SPT € Lab Tests Profile Penetration Depth ( Description of Material Blows/6 Blows/ft (N) Length Recovered 1.3 ft, Length Retained 1.3 ft û 0 (0) Fat CLAY, very soft, dark gray, moist, Homogeneous, no D-16 0 0 HCI reaction Length Recovered 1.5 ft, Length Retained 1.5 ft 0 50 0 (0)16 Fat CLAY, very soft, dark gray, moist, Homogeneous, no D-17 2 HCI reaction Length Recovered 0.8 ft, Length Retained 0.8 ft 1 55-(3) CL, MC=37%, Pi=24 Lean CLAY, very soft, dark gray, moist, Homogeneous, D-18 GS 0 MC 0 no HCl reaction OL3500 I-5 TO INTERNATIONAL BOUNDARY.GPJ SOIL, GDT 4/11/02012:35:45 P4 P! 0 60 Length Recovered 1.5 ft, Length Retained 1.5 ft 0 (0) Lean GLAY, very soft, dark gray, wet, Homogeneous, no D-19 Ð HCI reaction 0 Length Recovered 1.5 ft, Length Retained 1.5 ft 0 65-0 (0)Lean CLAY, very soft, dark gray, wet, Homogeneous, no D-20 0 HCl reaction 0



Job No.

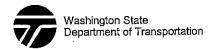
OL-3500

R 543

HOLE No. TH-3-01

PROJECT I-5 to International Boundary Sheet 4 of 6

	PRC	DJECT	1-5 10	Internat	ionai	Boundary						Sheet <u>4</u> of <u>6</u>			_
	Depth (fl)	Meters (m)	Profile		Standa Penetrai Blows/	tion	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab	Tests	Description of Material	Groundwater	Instrument	
	-	-22			         		0 0 (0)	X				Length Recovered 1.5 ft, Length Retained 1.5 ft	-		
	75—	- 23					0 0 0 1 (0)	X	D-21			Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.2 ft, Length Retained 1.2 ft	-		
	80-	- 24 -					0 0 0 1 (0)	X	D-22	М	iS IC ય	CL, MC=31%, PI≂16 Lean CLAY with sand, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft			
11/02E112;35;45 P4		—25 - -26					0 0 0 0 (0)		D-23			Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft	-		
SOIL OL3500 I-5 TO INTERNATIONAL BOUNDARY GPJ SOIL GDT 4/11/02/512:	90-	-27 -28					0 0 0 0 (0)		D-24			Lean CLAY, very soft, dark gray, wet, Homogeneous, no HĈI reaction Length Recovered 1.3 ft, Length Retained 1.3 ft		T <sub>e</sub>	
SOIL OL3500 I-5 TO INTER	- 95—	_					0	X	D-25			Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCI reaction	- -		



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SR \_\_\_\_\_543

HOLE No. TH-3-01

Sheet <u>5</u> of <u>6</u> I-5 to International Boundary PROJECT Groundwater nstrument Sample Type (Tube No.) Sample No. Standard Meters (m) SPT € Tests Profile Lab Penetration Description of Material Depth Blows/6 Blows/ft (N) 30 Lengtin Recovered 1.0 ft, Lengtin Retained 1.0 ft -29 2 3 (2) 30 CL, MC=31%, P!=28 D-26 GS 0 Lean CLAY, very soft, dark gray, wet, Homogeneous, no MC 0 HCI reaction ы 1 100 Length Recovered 1.3 ft, Length Retained 1.3 ft 2 (1) 31 Lean CLAY, very soft, dark gray, wet, Homogeneous, no 0 D-27 HCI reaction 0 Length Recovered 1.0 ft, Length Retained 1.0 ft 2 105-32 3 (2) D-28 Lean CLAY, very soft, dark gray, wet, Homogeneous, no 0 HCl reaction 0 Length Recovered 1.3 ft, Length Retained 1.3 ft SOIL 0L3500 I-5 TO INTERNATIONAL BOUNDARY.GPJ SOIL.GDT 4/11/02D12:35:45 P4 1 110-3 (1) Lean CLAY, very soft, dark gray, wet, Homogeneous, no D-29 0 HCI reaction 0 Length Recovered 1.3 ft, Length Retained 1.3 ft 1 115-2 (1) D-30 GS CL, MC=30%, Pl=10 0 Lean CLAY, very soft, dark gray, wet, Homogeneous, no MC 0

Job No.

0L-3500

SR \_\_\_\_\_543

PROJECT I-5 to International Boundary Sheet 6 of 6

PRO	JECT .	I-5 to	Inter	natio	nal B	ound	ary		_					Sheet <u>6</u> of 6		
Depth (fl)	Meters (m)	Profile	10	Sta Pen	andard netratio lows/ft	n		SPT Blows/6" (N)	Sample Type	Sample No.	(Tube No.)	Lab	Tests	Description of Material	Groundwater	Instrument
-	—37					1		1 3 (1)	X			P	1	HCI reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
125	38		)                 		                     	 		0 0 1 3 (1)	X	D	-31			Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
- 130—	—39 -		•		         			0 1 3 3 (4)	X	D	-32	-	·	Lean CLAY, soft, dark gray, wet, Homogeneous, no HCI reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
-	—40 		 	 	] ]		       							End of test hole boring at 131 ft below ground elevation.	  -  - 	
135-	-41			; ] ] ; ]		] 					!			This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.	  -  -	
42.00		1			 	1 1 1 1 1 1	 							7	-	
135-	-43			 	             	           						1			-	
OIL OLSBoar PS TO INT	-44			1 	! 			-							-	

Job Na.	0L-3500	SR	543		HOLE No						
PROJECT	I-5 to International Boundary	у	<u> </u>		Sheet <u>1</u> of <u>2</u>						
			<u> </u>		Inspector Brian Hilts	· 					
Station _	·	· 	Offset		Equipment <u>CME 55 w/ autohan</u>	nmer_	•				
Latitude	· · · · · · · · · · · · · · · · · · ·		Longitud	e	Method Wet Rotary	<del></del>					
Northing	323479.5		Easting	4608	245.2 Casing HQx32						
Ground Ele	vation 75.6 (23.0 m)		Start Dat	te No	vember 7, 2001 Completion Date November 7, 2	Completion Date November 7, 2001					
Depth (ft) Meters (rr)	Standard Penetration Blows/ft	SPT Blows/6" (N)	Sample Type Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater					
SOIL O13500 1-5 TO INTERNATIONAL BOUNDARY, GPJ 5-101-5 19 19 10 10 10 10 10 10 10 10 10 10 10 10 10	10 20 30 40	1 2 1 (3) 2 3 4 (7) 2 3 4 (7) 3 3 5 5 (8) 0 1 1 (2) 1 (3) 0 0 0 (0) 0 0 0 (0) 0 0 0 (0) 0 0 0 (0) 0 0 0 (0) 0 0 0 (0) 0 0 0 0	D-1 D-2 D-3 D-4 D-5 D-6 D-7 D-8 D-9 D-10	GS MC PI GS MC PI GS MC PI GS MC PI	SP, MC=9% Poorly graded SAND with gravel, very loose, grayish brown, moist, Stratified, no HCl reaction, with hair roots and the bottom. 4' was sandy silt and dark brown Length Recovered 0.8 ft, Length Retained 0.8 ft  1/11/02 11/20/01  CL, MC=27%, PI=19 Sandy lean CLAY, medium stiff, very dark grayish brown, moist, Homogeneous, no HCl reaction, with a trace of dark brown organics and hair roots Length Recovered 0.7 ft, Length Retained 0.7 ft  CH, MC=45%, PI=29 Fat CLAY, medium stiff, grayish brown, moist, Stratified, no HCl reaction, moist to dry, mottled orange and black with hair roots. Length Recovered 1.5 ft, Length Retained 1.5 ft Fat CLAY, medium stiff, grayish brown, moist, Homogeneous, no HCl reaction, moist to dry with FeO stains and hair roots. Length Recovered 1.5 ft, Length Retained 1.3 ft CL, MC=54%, PI=9 Lean CLAY, soft, gray, moist, Homogeneous, no HCl reaction, with FeO stains Length Recovered 1.5 ft, Length Retained 1.5 ft CH, MC=64%, PI=37 Fat CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft CH, MC=64%, PI=42 Fat CLAY, very soft, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft Fat CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft Fat CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft Fat CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft Fat CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft Fat CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft						



Job No.

<u>0L-3500</u>

SR \_\_\_\_\_543 · · \_\_\_

HOLE No. TH-4-01

PROJECT 1-5 to International Boundary Sheet 2 of 2

PRO	DJECT		O INTE	rnat	iouai	Boun	iuary	<del></del>	·		<del></del>	Sheet 2 of 2	
Depth (ft)	Meters (m)	Profile		P	Standa enetra Blows 20	tion . /ft	10	SPT Blows/6" (N)	Sample Type	Sample No.	Lab Tests	Description of Material	Instrument
-	-7			l             			           	0 0		D-11	GS MC	CL, MC=31%, PI=12 Lean CLAY, very soft, gray, wet, Laminated, no HCl	
25-	8				 	\$                 		0 (0)			Pi	reaction, with sand lenses Length Recovered 1.0 ft, Length Retained 1.0 ft	
30-	- g.						1 1 · 1 · 1 1 1 1	0 0 0 0 (0)	V	D-12		Lean CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 2.0 ft, Length Retained 1.5 ft  NOTE: At approx.14' we lost all water return and got a	
-	—10			 	1	               	! 1 1 1 1 1			ę,		little back every so often. The soil is very soupy and difficult to install a piezometer.  End of test hole boring at 29.5 ft below ground elevation.  This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.	
35	- 11 ·				[								
40—	-12			               			1						
	13				] ] ] ] ] ] ]								
45	-			 	1	1							-